

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

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| AISC M013 | (1983) Detailing for Steel Construction |
| AISC M016 | (1989) ASD Manual of Steel Construction |
| AISC M017 | (1992; Errata 1994) Connections |
| AISC S303 | (1992) Steel Buildings and Bridges |
| AISC S329 | (1985) Allowable Stress Design Specification for Structural Joints Using |
| ASTM A | 325 or A 490 Bolts |
| AISC S335 | (1989) Structural Steel Buildings Allowable Stress Design and Plastic Design |
| AISC S340 | (1992) Metric Properties of Structural Shapes with Dimensions According to ASTM A6M |
| AISC S341 | (1992) Seismic Provisions for Structural Steel Buildings |
| AISC S342L | (1993) Load and Resistance Factor Design Specification for Structural Steel Buildings |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

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| ANSI/ASME B46.1 | (1995) Surface Texture, (Surface Roughness, Waviness, and Lay) |
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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|------------|---|
| ASTM A 36 | (1996) Carbon Structural Steel |
| ASTM A 53 | (1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| ASTM A 108 | (1995) Steel Bars, Carbon, Cold Finished, Standard Quality |
| ASTM A 123 | (1997) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |

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| ASTM A 143 | (1974; R 1994) Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement |
| ASTM A 153 | (1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| ASTM A 307 | (1994) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength |
| ASTM A 325 | (1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi minimum Tensile Strength |
| ASTM A 490 | (1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength |
| ASTM A 500 | (1996) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A 513 | (1994) Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing |
| ASTM A 514 | (1994; Rev. A) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding |
| ASTM A 563 | (1996) Carbon and Alloy Steel Nuts |
| ASTM A 572 | (1997) High-Strength Low-Alloy Columbium-Vanadium of Structural Steel |
| ASTM A 618 | (1996) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing |
| ASTM A 668 | (1996) Steel Forgings, Carbon and Alloy, for General Industrial Use |
| ASTM A 780 | (1993; Rev. A) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| ASTM A 852 | (1997) Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi Minimum Yield Strength to 4 in. Thick |
| ASTM B 695 | (1991) Coatings of Zinc Mechanically Deposited on Iron and Steel |
| ASTM C 827 | (1995; Rev. A) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures |
| ASTM C 1107 | (1997) Packaged Dry, Hydraulic-Cement Grout (Nonshrink) |

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| ASTM F 436 | (1993) Hardened Steel Washers |
| ASTM F 844 | (1990) Washers, Steel, Plain (Flat), Unhardened for General Use |
| ASTM F 959 | (1996) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners |

AMERICAN WELDING SOCIETY, INC. (AWS)

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| AWS D1.1 | (1998) Structural Welding Code - Steel |
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FEDERAL SPECIFICATIONS (FS)

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|-------------|---|
| FS TT-P-664 | (Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant |
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MILITARY SPECIFICATIONS (MIL)

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|-------------|--|
| MIL-P-24441 | (Rev. B; Supp. 1) Paint, Epoxy-Polyamide |
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STEEL STRUCTURES PAINTING COUNCIL (SSPC)

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| SSPC SP 3 | (1995) Power Tool Cleaning |
| SSPC SP 6 | (1994) Commercial Blast Cleaning |
| SSPC Paint 25 | (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments) |
| SSPC PA 1 | (1991) Shop, Field, and Maintenance Painting |

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC M016 and AISC M017 except as modified in this contract.

1.3 MODIFICATIONS TO REFERENCES

In AISC M016, AISC M017, AISC 5335, AISC 5303, AISC 5329, and AISC S340, except as modified in this section, shall be considered a part of AISC M016 and AISC M017 and is referred to in this section as AISC M016 and AISC M017.

1.4 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.4.1 SD-02, Shop Drawings

- a. Fabrication drawings

1.4.2 SD-03, Product Data

- a. Load indicator washers
- b. Include test report for Class B primer.

1.4.3 SD-06, Test Reports

- a. Bolts, nuts, and washers

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

1.4.4 SD-07, Certificates

- a. Steel
- b. Bolts, nuts, and washers
- c. Shop primer
- d. Welding electrodes and rods
- e. Nonshrink grout
- f. AISC Quality Certification
- g. Welding procedures and qualifications

1.5 AISC QUALITY CERTIFICATION

Work shall be fabricated in an AISC certified Category Sbd fabrication plant.

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC M013, AISC M016 and AISC M017. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols

1.6.1.1 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

PART 2 - PRODUCTS

2.1 STEEL

2.1.1 Structural Steel

ASTM A 36

2.1.2 High-Strength Structural Steel

2.1.2.1 Low-Alloy Steel

ASTM A 572, Grade 50. ASTM A 852, plate.

2.1.3 Structural Steel Tubing

ASTM A 500, Grade B. Unless noted otherwise.

ASTM A513, For 1” mechanical square tubing; 14 gage minimum wall thickness.

2.1.4 Steel Pipe

ASTM A 53, Type E or S, Grade B, weight class STD (Standard).

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel.

2.2.1.1 Bolts

ASTM A 325, Type 1. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A 563M, Grade A, heavy hex style. ASTM A 563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F 844 washers for ASTM A 307 bolts, and ASTM F 436 washers for ASTM A 325 bolts.

2.2.2 High-Strength Structural Steel and Structural Steel Tubing.

2.2.2.1 Bolts

ASTM A 325MASTM A 325, Type 1.

2.2.2.2 Nuts

ASTM A 563, Grade and Style as specified in the applicable ASTM bolt standard.

2.2.2.3 Washers

ASTM F 436, plain carbon steel.

2.2.3 Foundation Anchorage

2.2.3.1 Bolts

ASTM A 307.

2.2.3.2 Nuts

ASTM A 563, Grade A, hex style.

2.2.3.3 Washers

ASTM F 844.

2.2.4 Load Indicator Washers

ASTM F 959.

2.2.5 Galvanized Drop-Forged Eye Bolts

Use 7/8" diameter galvanized drop-forged eye bolt with 1 3/4" inside diameter eye, 6" long with 4" minimum thread length with washer and hex nut and a minimum working load limit of 7000 lbs. by McMaster-Carr or approved equal.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1., E70 Series Electrodes

2.3.2 Nonshrink Grout

ASTM C 1107, with no ASTM C 827 shrinkage. Grout shall be nonmetallic.

2.3.3 Welded Shear Stud Connectors

AWS D1.1.

2.4 SHOP PRIMER

FS TT-P-664, SSPC Paint 25, or MIL-P-24441/1 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC M016 and AISC M017 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 FABRICATION

2.5.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded or on surfaces of weathering steels that will be exposed in the completed structure. Do not locate match markings in areas that will decrease member strength or cause stress concentrations

2.5.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive sprayed-on fireproofing, [surfaces to receive epoxy coatings, surfaces designed as part of a composite steel concrete section, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.5.2.1 Cleaning

SSPC SP 6, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.5.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

2.5.3 Fireproofing and Epoxy Coated Surfaces

Surfaces to receive sprayed-on fireproofing or epoxy coatings shall be cleaned and prepared in accordance with the manufacturer's recommendations, and as specified in Section 07810, "Spray-Applied Fireproofing".

PART 3 - EXECUTION

3.1 ERECTION

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.2 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC S335. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.2.1 Common Grade Bolts

ASTM A 307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.2.2 High-Strength Bolts

ASTM A 325M bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Provide load indicator bolts or washers in all ASTM A 325M bolted connections, except provide only load indicator washers for slip critical connections. Direct tension indicator tightening, or installation of alternate design fasteners, shall be the only acceptable tightening methods. Use only direct tension indicator tightening for slip critical connections. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.2.2.1 Installation of Load Indicator Washers (LIW)

ASTM F 959. Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F 436 washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening.

3.3 WELDING

AWS D1.1, Grind exposed welds smooth as indicated. Provide AWS D1.1 qualified welders, welding operators, and tackers.

3.3.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.4 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.5 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

3.5.1 Load Indicator Washers

3.5.1.1 Load Indicator Washer Compression

Load indicator washers shall be tested in place to verify that they have been compressed sufficiently to provide the 0.015 inch gap when the load indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.005 inch gap when the load indicator washer is placed under the turned element, as required by ASTM F 959.

3.5.1.2 High-Strength Bolts

3.5.1.3 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in AISC S329, Table 4, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

3.5.1.4 Inspection

Inspection procedures shall be in accordance with AISC S329, Section 9. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

3.5.1.5 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension requirements. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations shall be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, shall be tested. Retest new bolts after installation.

END OF SECTION